1820B
RF Mount Heater

Instruction and Service Manual

PN# 1820B-900-01
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REV. A

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TEGAM is a manufacturer of electronic test and measurement equipment for metrology, calibration, and production test. We also provide repair, calibration, and other support services for a wide variety of test and measurement equipment including RF power sensor calibration systems, RF attenuation measurement systems, ratio transformers, arbitrary waveform generators, micro-ohmmeters, LCR meters, handheld temperature calibrators, thermometers, humidity and temperature control devices, and more.

TEGAM also repairs and calibrates test and measurement equipment formerly manufactured by Electro-Scientific Industries (ESI), Gertsch, Keithley Instruments, Lucas Weinschel, and Pragmatic Instruments. A complete list can be viewed on our Product Service Directory at www.tegam.com

For more information about TEGAM and our products, please visit our website at www.tegam.com, or contact one of our customer service representatives at sales@tegam.com or 800-666-1010.

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Table of Contents

Section Page

I. Introduction
- Purpose and Functions 1-1
- Capabilities 1-1
- Specifications 1-1
- List of Items Furnished 1-3
- List of Optional Accessories 1-3
- Warranty Information 1-4
- Contact Information 1-4

II. Preparation for Use and Installation
- Unpacking and Inspection 2-1
- Use in Proper Environment 2-1

III. Principles of Operation
- 1820B Metering Operation 3-1
- Understanding the 1820B 3-1

IV. Operating Instructions
- Start-up Procedure 4-1
- Connecting the Proper Sensor 4-2

V. Maintenance and Servicing
- Troubleshooting 5-1
- RF Dual Mount Temperature Controller Schematic 5-2
- 3.5 DPM Interface Schematic 5-5

VI. Reprogramming
- Memory Sanitization Procedure 6-1

VII. Preparation for Shipment
- Preparation for Repair or Calibration Service 7-1
- Returning Instrument for Service 7-3
- Package Instrument for Shipment 7-3

VIII. Storage
- Storage Requirement 8-1

Safety Information & Precautions:
The following safety information applies to both operation and service personnel. Safety precautions and warnings may be found throughout this instruction manual and the equipment. These warnings may be in the form of a symbol or a written statement. Below is a summary of these precautions.

Terms in This Manual:
CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Terms as Marked on Equipment:
CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Symbols:
As Marked in This Manual:

	This symbol denotes where precautionary information may be found.

As Marked on Equipment:

	CAUTION – Risk of Danger
	DANGER – Risk of Electric Shock
	Earth Ground Terminal
I	On
O	Off
	Frame or Chassis Terminal
	Earth Ground Terminal
	Alternating Current

Purpose and Function

The Model 1820B RF Mount Temperature Controller provides a stable power source for one or two Precision RF Power Standards (mounts).

Key functions of the 1820B:

- Replaces the 1820 RF Mount Heater
- Compatible with all TEGAM thermistor power standards

Capabilities

The Model 1820B maintains the mount at operating temperature, reducing warm up time. The operator can leave the mounts connected and they remain at operating temperature ready for connection to the Model 1830A RF Power Meter at any time to begin taking measurements.

Specifications

(Includes performance characteristics, description, power and utility information and environmental information)

Temperature Controller	
Bias Power Temperature Sensitivity	2uW/°C per hour
Mount Warm-Up Time	2 hours
Ambient Temperature Dynamic Range	+12 °C to +40 °C (+54 °F to +104 °F)
Internal Mount Temperature	+ 60 °C (+140 °F) nominal[1]
Warm-Up Drive (saturated)	12-14 V @ 200 mA minimum
Indicator	Current, mA
Accuracy, Current Measurement	±(2.0% of reading + 3 counts)[2]
Connectors	2 x 4 pin miniature microphone (audio) connector
Environmental, Specified Temperature Range	
Operating Temperature	0 °C to +55 °C (+32 °F to +131 °F)
Storage Temperature	-40 °C to +75 °C (-40 °F to +167 °F)
Power Requirements	100 to 240 VAC, 47 to 63 Hz, 100 VA max
Input Power Fuse	250 V, 1.5 Amp (slow blow)
Weight	2 kg (4.4 lb)
Physical Dimensions	
Height	8.89 cm (3.5 in)
Width	21.59 cm (8.5 in)
Depth	33.02 cm (13 in)

[1]Dependant on Mount Design and adjustments.
[2]Applies for current levels greater than 10 mA.

Table 1.1 *Physical and Electrical Specifications*

Power Source
This product is intended to connect to a power source that the voltage between the supply conductors or between either supply conductor and ground will not apply more than the voltage rating for the particular power supply. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Line Voltage Selection
The power supply in a Model 1820B operates with a line voltage of 100 to 240 VAC, 47 to 63 Hz, 100 VA max.

CAUTION DO NOT APPLY POWER TO THE INSTRUMENT BEFORE READING THIS SECTION.

Check the Power Cord
Make sure the power cord supplied with the Model 1820B is not frayed, broken, or cracked. A damaged power cord is a fire and electrical hazard. If the power cord is damaged, it should be replaced.

Use the Proper Fuse
To avoid fire hazard, use only the correct fuse type as specified for the AC power supply in the unit. The correct fuse for the 1820B is a 250 V 1.5 Amp slow blow fuse.

The fuse is located just below the power cord socket. Before replacing the fuse, place the Model 1820B front panel power switch to the OFF position and remove power cord on the back of the Model 1820B. To replace the fuse, gently slide out the fuse drawer. Remove the old fuse and snap a new one into the fuse holder. Reinstall the fuse by simply pushing the fuse drawer back into its original position. The fuse drawer should snap into place.

Grounding the Equipment
This product is grounded through the grounding conductor of the power cord.
WARNING To avoid electrical shock or other potential safety hazards, plug the power cord into a properly wired receptacle before using this instrument. The proper grounding of this instrument is essential for safety and optimizing instrument operation.

Danger Arising from Loss of Ground
WARNING If the connection to ground is lost or compromised, a floating potential could develop in the instrument. Under these conditions all accessible parts, including insulating parts such as keypads and buttons could develop a hazardous voltage and put the user at risk.

List of Items Furnished

Item
Power Cord
User/Maintenance Manual
Statement of Calibration

Table 1.2 *– 1820B Packing List*

List of Optional Accessories

Accessory	Part Number
Heater Cable (4 pin mini, 48” or 15”)	CA-11-48/CA-11-15
Heater Cable (4 pin large, 48” or 15”)	CA-10-48/CA-10-15
Sensor Cable (15XX/25XX, 48” or 15”)	CA-21-48/CA-21-15
Rack Mount Kit (Single Unit)	1830-910
Rack Mount Kit (Dual Unit)	1830-911

Table 1.3 *- 1820B Accessory List*

Warranty Information

TEGAM, Inc. warrants this product to be free from defects in material and workmanship for a period of one year from the date of shipment. During this warranty period, if a product proves to be defective, TEGAM Inc., at its option, will either repair the defective product without charge for parts and labor, or exchange any product that proves to be defective.

TEGAM, Inc. warrants the calibration of this product for a period of one year from date of shipment. During this period, TEGAM, Inc. will recalibrate any product, which does not conform to the published accuracy specifications.

In order to exercise this warranty, TEGAM, Inc., must be notified of the defective product before the expiration of the warranty period. The customer shall be responsible for packaging and shipping the product to the designated TEGAM service center with shipping charges prepaid. TEGAM Inc. shall pay for the return of the product to the customer if the shipment is to a location within the country in which the TEGAM service center is located. The customer shall be responsible for paying all shipping, duties, taxes, and additional costs if the product is transported to any other locations. Repaired products are warranted for the remaining balance of the original warranty, or 90 days, whichever period is longer.

Warranty Limitations

The TEGAM, Inc. warranty does not apply to defects resulting from unauthorized modification or misuse of the product or any part. This warranty does not apply to fuses, batteries, or damage to the instrument caused by battery leakage.

Contact Information:

TEGAM Inc.
10 Tegam Way
Geneva, OH 44041
PH: 440.466.6100
FX: 440.466.6110
EMAIL: ***sales@tegam.com***
WEB: *http://www.tegam.com*

Document publishing dates may lag product changes.
Visit www.tegam.com to download the latest version of this manual.

Unpacking and Inspection

Each 1820B is put through a series of electrical and mechanical inspections before shipment to the customer. Upon receipt of your instrument unpack all of the items from the shipping carton and inspect for any damage that may have occurred during transit. Report any damaged items to the shipping agent. Retain and use the original packing material for reshipment if necessary.

Upon Receipt, inspect the carton for the following items:

Model 1820B Mount Heater
Model 1820B Operating and Service Manual (CD) P/N 1820B-901
Calibration Certificate
Power Cord

Mounting

The Model 1820B is shipped with four feet mounted to the bottom cover. When the Model 1820B is placed on a bench or table, these feet support the instrument. The Model 1820B can also be rack mounted in a standard 19" rack using the optional rack adapter kit 1830-910 for a single 1820B and kit 1830-911 to rack 1820B and 1830A side-by-side.

NOTE It is recommended to remove all 4 feet prior to rack mounting.

Use in Proper Environment

Normal calibration laboratory practice dictates that the environment should be closely controlled. This will minimize errors introduced by temperature and humidity changes. A nominal temperature as specified in Table 1.1 provides a good working condition. Controlled temperatures also stabilize the aging process of the standards.

Do Not Use in Explosive Environments

CAUTION The 1820B is not designed for operation in explosive environments.

Ensure Power Switch is Accessible

CAUTION Ensure that the POWER switch is easily accessible at all times and nothing is in place that would impede proper use.

Do Not Operate Without Covers

WARNING This device should be operated with all panels and covers in place. Operation with missing panels or covers could result in personal injury.

1820B Metering Operation

The 1820B uses a variable voltage control circuit as the regulating system for an RF thermistor mount's heating elements. This is a closed loop system that uses the internal temperature as the feedback mechanism.

The current supplied to the heating elements are monitored and displayed. A 3 ½ digit panel meter (DPM), with 1 mA resolution, is used for this display.

You will observe that the display shows 6 or 7 counts without connection to any device. That is, without a load, or a thermistor mount connected, the instrument displays non-linear value of 6 to 7 mA. This is normal operation and is neither an offset nor error. This non-linearity is due to the operation of the specific current monitoring integrated circuit used within the design.

When the instrument measures a current greater than 7 mA, the performance is linear and conforms to the stated accuracy specification. Typically, a thermistor mount's heating elements require 160 mA or more to operate effectively. These currents ensure linear and valid measurements as shown on the 1820B's digital panel meters.

Understanding the 1820B Heating Process

The Model 1820B is designed for continuous operation; therefore, no further operator action is required for precise temperature control of the mount(s).

The 1820B is variable voltage control circuit. When a thermistor mount is connected to the 1820B, the heater circuit will supply (nominally) 13 Vdc, ± 1 Vdc. Heater current is then a function of the internal mount temperature. This current will reach a maximum with a cold (room temperature) mount and then decrease as the internal heating elements warm up. The DC substituted power changes significantly during this warm up period. When the mount's heating elements reach design temperature, the control circuit reduces the heater voltage to maintain an internal temperature of 60 °C. You will observe a dip in heater current at that point, after which the current change is minimal.

NOTE Most cold thermistor mounts typically require 60 to 90 minutes to reach an internal temperature of approximately 60 °C. This cold current is a function of the mount type and construction. Once this internal temperature is reached, the control circuit sources a warming current to maintain that temperature. Some thermistor mounts may require 230 mA to stay warm; whereas, most take less than 200 mA. The key to the mount being ready is that the DC substituted power has reached a steady-state value. Refer to Figure 3.1 for a graphical view.

Likewise, the measured current displayed by the 1820B's digital panel meters can provide an indication that a mount's internal temperature has reached 60 °C. Observing and recording the measured current, when a thermistor mount is first connected, will provide the cold current value. (Note that a thermistor mount, if disconnected momentarily, immediately starts to cool. When reconnected the mount again requires its cold current until the control circuit regulates to the 60 °C internal temperature. The time period for this regulation is typically several minutes versus 60 minutes or longer, stated above.) This cold current then reduces to the warming

current value. Monitoring this current change from the 1820B's digital panel meters can provide this indication. As stated above, and shown in Fig. 3.1, there is a notable change between the cold and warming currents. The warming current will typically be maintained, within a few milliamps, based upon the environment's ambient temperature.

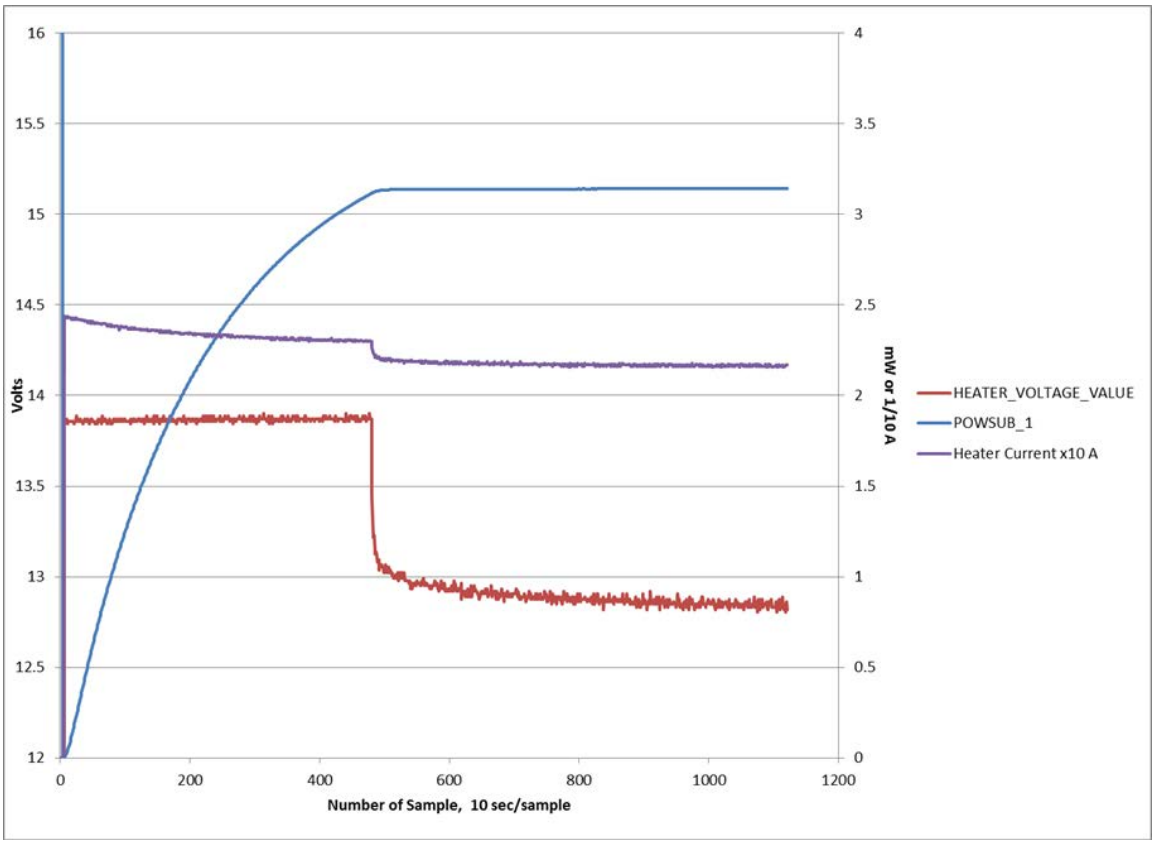


Figure 3.1 *1820B Warm-up Relationship*

Start-up Procedure

After unpacking the 1820B and setting up in the proper operating environment, plug in the AC power cord. Connect the proper cable and thermistor mount and turn on the 1820B

Connecting the Proper Sensor

There are many thermistor based RF power sensors available. The Model 1820B is designed to heat all TEGAM thermistor mounts.

Sensor Cable (15XX/25XX, 48” or 15”)	CA-21-48/CA-21-15
Heater Cable (F113X, 48” or 15”)	CA-11-48/CA-11-15
Heater Cable (M113X, 48” or 15”)	CA-10-48/CA-10-15

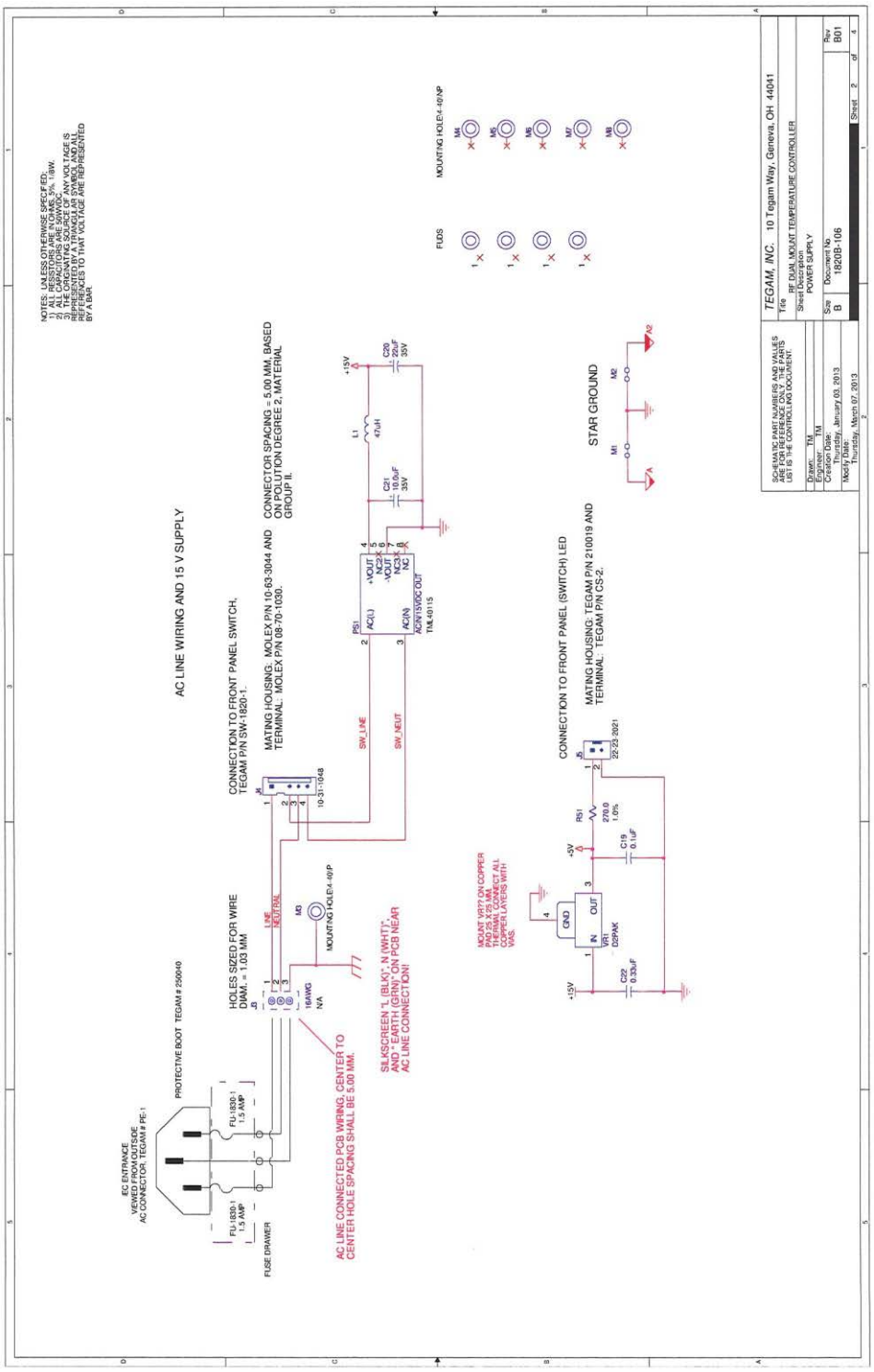
Troubleshooting

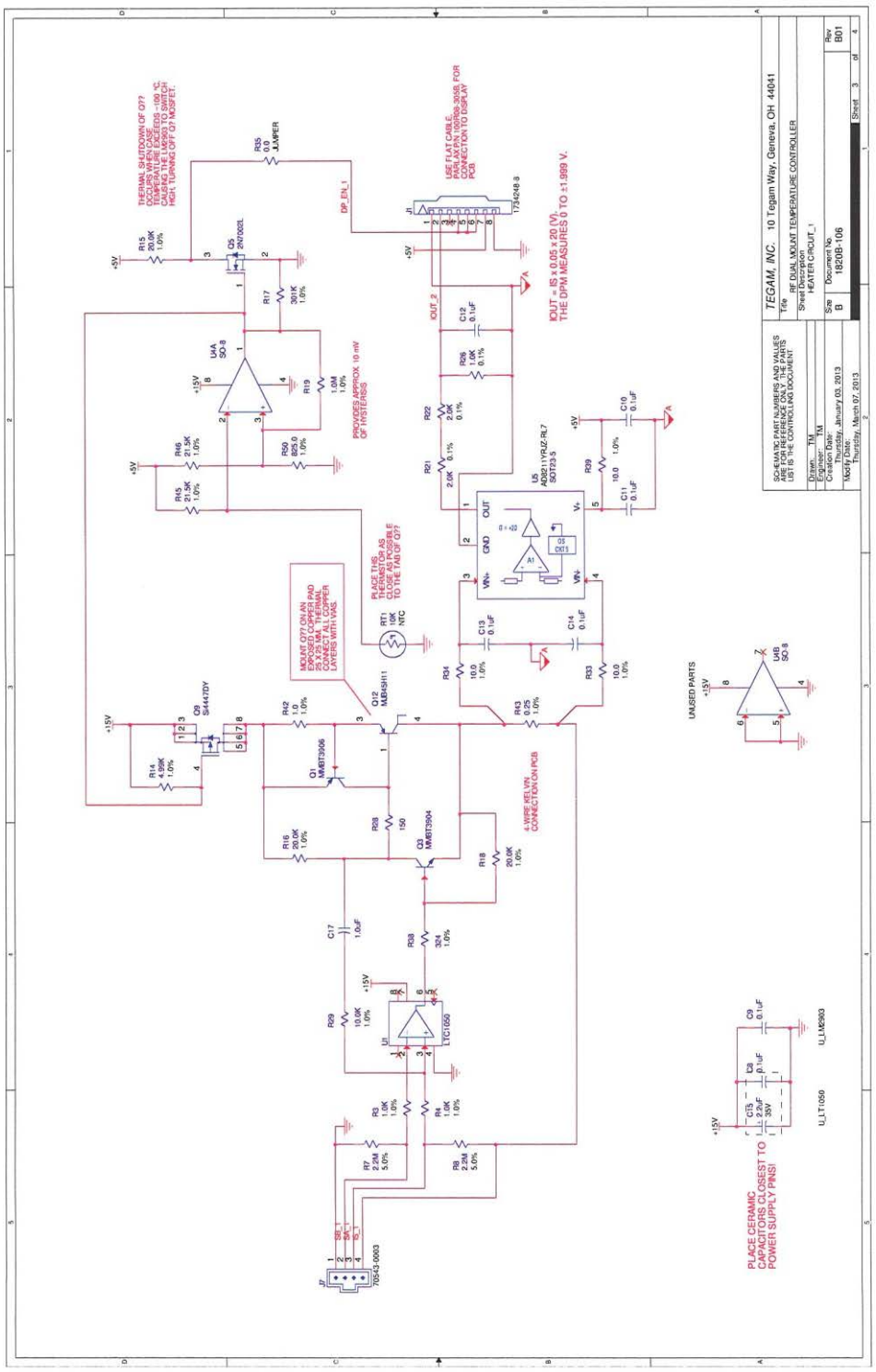
The TEGAM, INC. Model 1820B has been designed to provide many years of trouble-free performance. However, there are some instances where harsh operating environments or excessive physical strain may cause premature failure. Should a malfunction of the 1820B be discovered, it is recommended that certain steps be taken in order to assist our service department in identifying the cause of the malfunction. Below is a summary of some commonly observed symptoms and some possible causes.

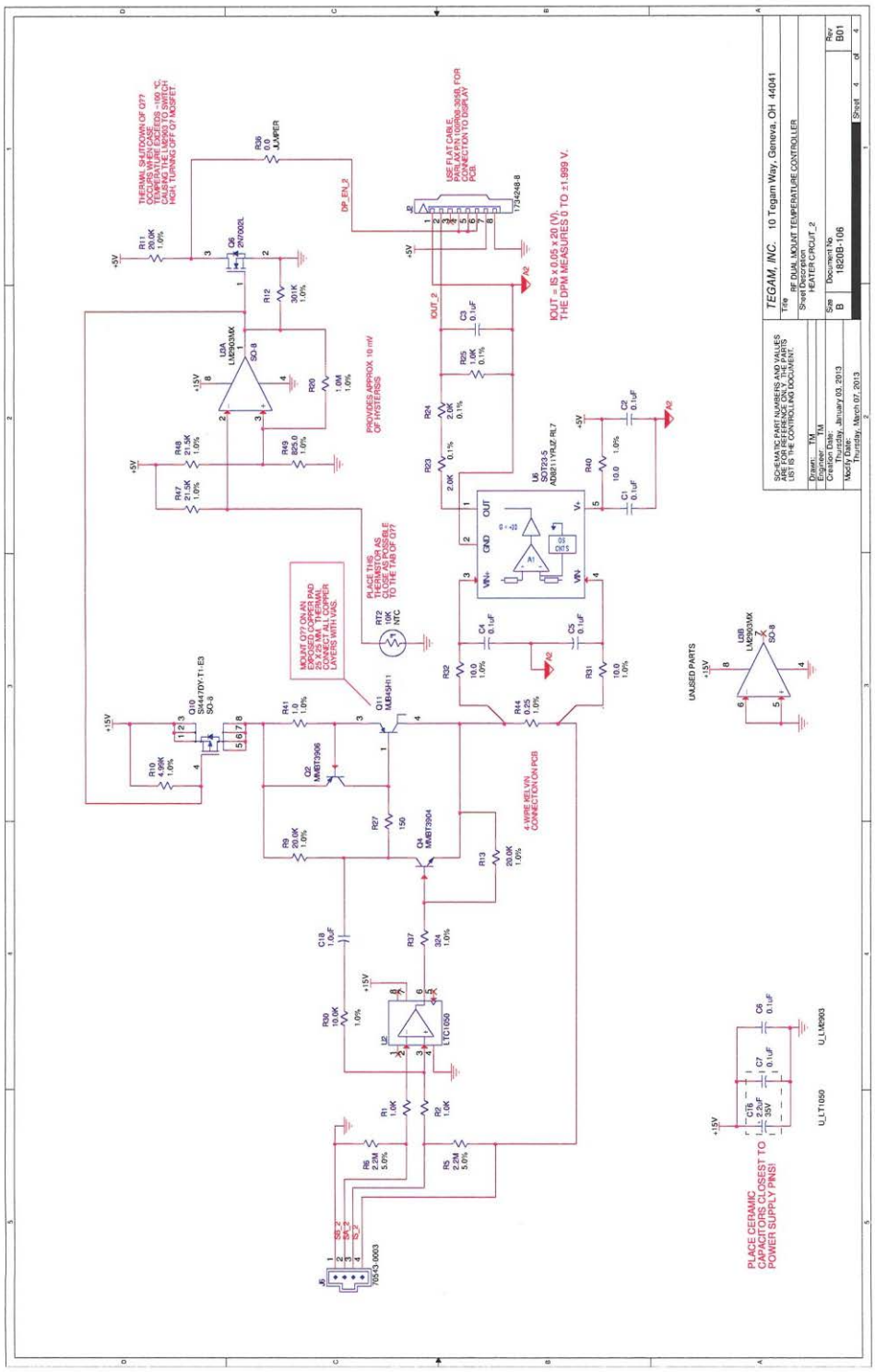
No Power:

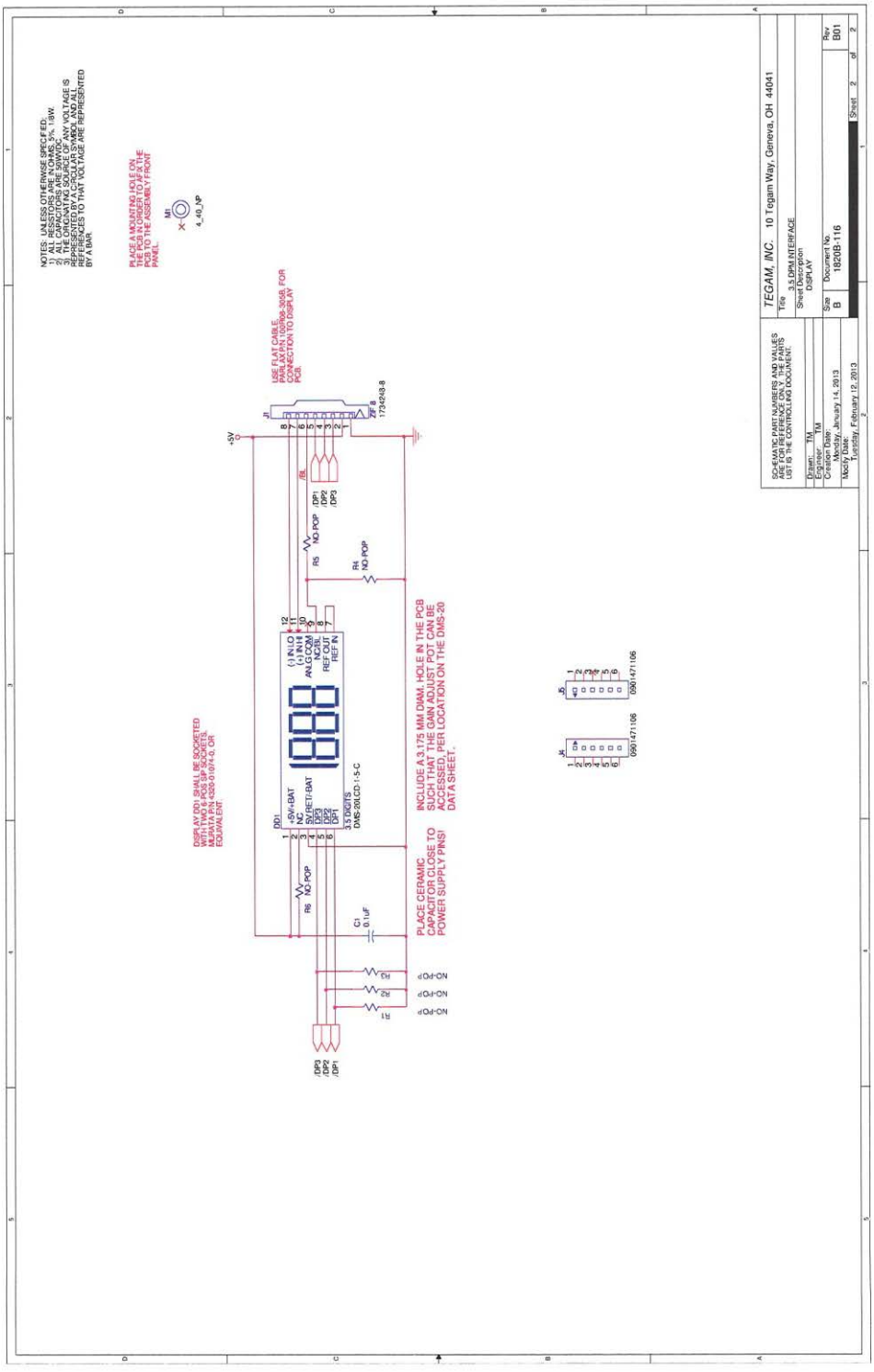
Check power cord
Check fuse

No Serviceable Parts


AC LINE WIRING AND 15 V SUPPLY
PROTECTIVE BOOT TEGAM # 256049
HOLES SIZED FOR WIRE DIAM. = 1.03 MM
FUSE DRAWER
FU-1830-1 1.5 AMP
MOUNTING HOLE 4-40 P
16AWG N/A
AC LINE CONNECTED PCB WIRING, CENTER TO CENTER HOLE SPACING SHALL BE 5.00 MM.
SILKSCREEN "L (BLK)", N (WHT)", AND EARTH (GRN) ON PCB NEAR AC LINE CONNECTION
CONNECTION TO FRONT PANEL SWITCH, TEGAM P/N SW-1820-1.
MATING HOUSING: MOLEX P/N 10-63-3044 AND TERMINAL: MOLEX P/N 08-70-1030.
CONNECTOR SPACING = 5.00 MM, BASED ON IEC 61 076-2-101 DEGREE 2, MATERIAL GROUP III.
10-31-1048
SW_LINE
SW_NEUT
PS1
AC(L)
AC(N)
+VOUT
-VOUT
NC
AC/N1/VDC-OUT
TML40115
+15V
L1
47uH
C21
1000uF
35V
C20
1000uF
35V
STAR GROUND
M1
M2
CONNECTION TO FRONT PANEL (SWITCH) LED
MATING HOUSING: TEGAM P/N 2100019 AND TERMINAL: TEGAM P/N GS-2.
22-23-2021
RS1
270.0
1.0%
C19
0.1uF
+5V
GND
IN
OUT
VR1
D2PAK
C22
0.33uF
MOUNT VR?? ON COPPER PAD 25 X 25 MM. REMEMBER TO CONNECT ALL COPPER LAYERS WITH VIAS.
FLDS
MOUNTING HOLE 4-40 NP
M4
M5
M6
M7
M8
TEGAM, INC. 10 Tegam Way, Geneva, OH 44041
Title RF DUAL MOUNT TEMPERATURE CONTROLLER
Sheet Description POWER SUPPLY
Size B
Document No. 1820B-106
Rev B01
Sheet 2 of 4
Drawn: TM
Engineer: TM
Creation Date: Thursday, January 03, 2013
Modified Date: Thursday, March 07, 2013


TEGAM, INC. 10 Tegam Way, Geneva, OH 44041
RF DUAL MOUNT TEMPERATURE CONTROLLER
HEATER CIRCUIT_1
Document No. 18208-106
Rev B01
Sheet 3 of 4
Drawn: TM
Checked: TM
Creation Date: Thursday, January 03, 2013
Modified Date: Thursday, March 07, 2013
SCHEMATIC PART NUMBERS AND VALUES ARE FOR REFERENCE ONLY. BOM LIST IS THE CONTROLLING DOCUMENT
IOUT = (5 x 0.05 x 20 Ω) / THE DPM MEASURES 0 TO ±1.999 V.
USE FLAT CABLE, PARLAX P/N 100780-3036 FOR CONNECTION TO DISPLAY PCB
THERMAL SHUTDOWN OF Q77 OCCURS WHEN HEATSINK TEMPERATURE EXCEEDS ~100 °C. CAUSES THE MAX6501 OUTPUT TO GO HIGH, TURNING OFF Q7 MOSFET.
PROVIDES APPROX. 10 mV OF HYSTERESIS
PLACE THIS THERMISTOR AS CLOSE AS POSSIBLE TO THE TAB OF Q7
MOUNT Q77 ON AN EXPOSED COPPER PAD ON THE PCB. IF MULTIPLE LAYERS, CONNECT ALL COPPER LAYERS WITH VIAS.
4-WIRE RTD VIA CONNECTION ON PCB
UNUSED PARTS
PLACE CERAMIC CAPACITORS CLOSEST TO POWER SUPPLY PINS!
DP_EN_1
IOUT_2
U1 LTC1050
U_LT1050
U_LM393
U5 AD8211YRJZ-RL7
U12 MMBSH11
Q1 MMBT3906
Q3 MMBT3904
Q9 SI4447DY
Q77 2N7002L
U48 SO-8
U4A SO-8
J1 1734248-8
JP 70543-0003
R35 0.0 JUMPER
R15 200K 1.0%
R17 301K 1.0%
R19 1.0M 1.0%
R50 100K 1.0%
R6 21.5K 1.0%
R45 21.5K 1.0%
R14 4.99K 1.0%
R12 1.0 1.0%
R16 20.0K 1.0%
R28 150
R18 20.0K 1.0%
R38 324 1.0%
R29 10.0K 1.0%
R3 1.0K 1.0%
R4 1.0K 1.0%
R7 2.2M 5.0%
R8 2.2M 5.0%
R22 2.0K 0.1%
R21 2.0K 0.1%
R96 10K 0.1%
R34 10.0 1.0%
R33 10.0 1.0%
R13 0.05 1.0%
R39 10.0 1.0%
RT1 10K NTC
C12 0.1uF
C13 0.1uF
C14 0.1uF
C10 0.1uF
C11 0.1uF
C17 1.0uF
C9 0.1uF
C15 2.2uF 50V
C8 0.1uF
SW_1
SW_2
SW_3
SW_4


TEGAM, INC. 10 Tegam Way, Geneva, OH 44041
RF DUAL MOUNT TEMPERATURE CONTROLLER
HEATER CIRCUIT_2
Size B
Document No 1820B-106
Rev B01
Sheet 4 of 4
Drawn: TM
Engineer: TM
Creation Date: Thursday, January 03, 2013
Modify Date: Thursday, March 07, 2013
SCHEMATIC PART NUMBERS AND VALUES ARE FOR REFERENCE ONLY. THE PARTS LIST IS THE CONTROLLING DOCUMENT.
THERMAL SHUTDOWN OF Q77 OCCURS WHEN CASE TEMPERATURE EXCEEDS +160 °C. THIS WILL CAUSE U3 (SHUTDOWN) TO SWITCH HIGH TURNING OFF Q7 MOSFET.
USE FLAT CABLE PARLAX P/N 100R06-305B FOR CONNECTION TO DISPLAY PCB.
IOUT = I/5 x 0.05 x 20 (V). THE DPM MEASURES 0 TO ±1.999 V.
PROVIDES APPROX. 10 mV OF HYSTERSIS
MOUNT Q77 ON AN EXPOSED COPPER PAD ON THE PCB. THERMAL CONNECT ALL COPPER LAYERS WITH VIAS.
PLACE THIS THERMISTOR AS CLOSE AS POSSIBLE TO THE TAB OF Q77
4-WIRE RTD TYP. CONNECTION ON PCB
UNUSED PARTS
PLACE CERAMIC CAPACITORS CLOSEST TO POWER SUPPLY PINS!


NOTES: UNLESS OTHERWISE SPECIFIED:
1) ALL RESISTORS ARE R-0402, 5%, 1/8W.
2) ALL CAPACITORS ARE 0402, X7R.
3) THE ORDINATING SOURCE OF ANY VOLTAGE IS REFERENCED TO GND. ALL VOLTAGE LEVELS ARE REFERENCED TO THAT VOLTAGE ARE REPRESENTED BY A BAR.
PLACE A MOUNTING HOLE ON THE PCB IN ORDER TO MOUNT THE PCB TO THE ASSEMBLY FRONT PANEL.
M1
4_40_NP
USE FLAT CABLE, PARLAN P/N 100908-3606, FOR CONNECTION TO DISPLAY PCB.
J1
ZIF 8
1734248-8
+5V
J6
DP1
DP2
DP3
R5
NO-POP
R4
NO-POP
DISPLAY DD1 SHALL BE SOCKETED WITH TWO 8 POS SIP SOCKETS, MAX-A-PAC #A08-SW-A-LOK OR EQUIVALENT
DD1
+5V-BAT
NC
SW-RET/-BAT
DP3
DP2
DP1
3.5 DIGITS
DMS-20LCD-1-5-C
(-) IN LO
(+) IN HI
ANLG COM
REF OUT
REF IN
INCLUDE A 3.175 MM DIAM. HOLE IN THE PCB SUCH THAT THE GAIN ADJUST POT CAN BE ACCESSED, PER LOCATION ON THE DMS-20 DATA SHEET.
R6
NO-POP
C1
0.1 uF
PLACE CERAMIC CAPACITOR CLOSE TO POWER SUPPLY PINS!
R3
R2
R1
NO-POP
NO-POP
NO-POP
DP3
DP2
DP1
J5
J4
0901471106
0901471106
SCHEMATIC PART NUMBERS AND VALUES ARE REFERENCED ON THE PARTS LIST IS THE CONTROLLING DOCUMENT.
TEGAM, INC. 10 Tegam Way, Geneva, OH 44041
Title 3.5 DPM INTERFACE
Sheet Description DISPLAY
Drawn: TM
Engineer: TM
Creation Date: Monday, January 14, 2013
Modification Date: Tuesday, February 12, 2013
Size B
Document No. 1820B-116
Rev B01
Sheet 2 of 2

Memory Sanitization Procedure

There is no memory of any kind to be sanitized with the 1820B.

Preparation for Repair or Calibration Service

Once you have verified that the cause for 1820B malfunction cannot be solved in the field and the need for repair and calibration service arises, contact TEGAM customer service to obtain a Return Material Authorization (RMA) number. You can contact TEGAM customer service via the website, www.tegam.com, or by calling 440.466.6100 (*All Locations*) OR 800.666.1010 (*United States Only*).

The RMA number is unique to your instrument. The RMA both identifies the instrument and your specific service request

Equally important is a detailed written description of the problem. It is recommended that you attach this document to the instrument. Many times servicing is unnecessarily delayed due to a lack of repair instructions or a detailed description of the problem.

This description should include information such as measurement range and other instrument settings, component type(s) being tested, are the symptoms intermittent, conditions that may cause the symptoms, has anything changed since the last time the instrument was used, etc. Any detailed information provided to TEGAM's technicians will assist in identifying and correcting the problem in the quickest possible manner. Use a copy of the Expedite Repair & Calibration Service form provided on the next page.

Expedite Repair & Calibration Form

Use this form to provide additional repair information and service instructions. The Completion of this form and including it with your instrument will expedite the processing and repair process.

RMA#:		Instrument Model #:	
Serial Number:		Company:	
Technical Contact:		Phone Number:	
Additional Contact Info:			

Repair Instructions:

☐ Evaluation ☐ Calibration Only ☐ Repair Only ☐ Repair & Calibration ☐ Z540 (Extra Charge)

Detailed Symptoms:

Include information such as measurement range, instrument settings, type of components being tested, is the problem intermittent? When is the problem most frequent? Has anything changed with the application since the last time the instrument was used?, etc.

Returning Instrument for Service

Use the information in this section if you need to return your instrument to TEGAM.

Package Instrument for Shipment

Use the following steps to package the instrument for shipment to TEGAM for service:

1. Complete the EXPEDITE REPAIR & CALIBRATION FORM (previous page) and attach it to the instrument. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:
   - Any error messages that appeared on the instrument display.
   - Any information on the performance of the instrument.

2. Use the original packaging materials or a strong shipping container. The carton must be both large enough and strong enough to accommodate the instrument and allow at least three to four inches on all sides of the instrument for packing material.

3. Surround the instrument with at least three to four inches of packing material or enough to prevent the instrument from moving in the carton.

4. Seal the shipping container securely with strong nylon adhesive tape.

5. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to ensure careful handling.

Caution: Instrument damage can result from using packaging materials other than those specified.

6. Retain copies of all shipping papers.

Storage Requirements

When the Model 1820B is to be stored for extended periods, pack the instrument into a container. Place container in a clean, dry, temperature-controlled location. If instrument is to be stored in excess of 90 days, place desiccant with items before sealing container.